lished by C. A. Davis * and by Blatchley and Ashley.†

My observations upon the growth of stream deposits of travertine in Tennessee and California led me to the following conclusions:

1. The deposits grow more rapidly in the summer and at low-water stages.

2. The channels become locally choked up with travertine and the streams are compelled to shift from side to side.

3. The thin horizontal beds of travertine are formed in the shallow waters immediately above the falls.

4. Although the larger streams appear to be eroding and do erode at high stages and at certain parts of their courses, the process on the whole is constructive.

5. The travertine tends to form a series of terraces along the streams depositing it.

J. C. BRANNER.

STANFORD UNIVERSITY, July 4, 1901.

PSEUDOSCOPIC VISION WITHOUT A PSEUDOSCOPE.‡

A METHOD of securing an illusion of binocular vision wholly without instrumental aid occurred to me recently, which is interesting in connection with the study of pseudoscopic vision. It is fully as startling as any of the results obtained with the lenticular pseudoscope, which I described in SCIENCE (about Nov., 1899), and, requiring the aid of no optical instrument, is very much more impressive. A lead pencil is held point up an inch or two in front of a wire window screen, with a sky background. If the eyes are converged upon the pencil point, the wire gauze becomes somewhat blurred and of course doubled. Inasmuch, however, as the gauze has a regularly recurring pattern the two images can be united, and a little effort enables one to accommodate for distinct vision of the united images of the mesh. To accommodate for a greater distance than the point upon which the eyes are converged requires practice, but the trick is very much easier in this case than in the case of viewing stereoscopic pictures without a stereoscope. As soon as accommodation is secured the mesh becomes perfectly sharp, and appears to lie nearly in the plane of the pencil point, which still appears single and fairly sharp. If now the pencil is moved away from the eyes, which are to be kept fixed on the screen, the point *passes through the mesh* and appears double, the distance between the two images increasing until the point touches the screen.

If now the pencil be removed it will be found that the sharp image of the combined images of the gauze persist, even though the eyes be moved nearer to or farther away from the screen. Move the eyes up to within six or eight inches of the plane in which the screen appears to lie and try to touch it with the finger. *It is not there.* The finger falls upon empty space, the screen being, in reality, a couple of inches further off. This is by all means the most startling illusion that I have ever seen, for we apparently see something occupying a perfectly definite position in space before our eyes, and yet if we attempt to put our finger on it, we find that there is nothing there.

It is best to begin by holding the pencil an inch or less in front of the screen. As the eyes become accustomed to the unusual accommodation the distance can be increased. The greater the distance, the greater the illusion, of course. I have succeeded in bringing up the apparent plane of the mesh five or six inches, but this requires as great a control over the eyes as is necessary in viewing stereoscopic views without an instrument.

R. W. WOOD.

* *Jour. of Geology*, Sept.–Oct., 1900, VIII., 485–503.

† 'The Lakes of Northern Indiana and their Associated Marl Deposits,' by Blatchley and Ashley, 25th Ann. Rep. State Geologist of Ind., pp. 43–51.

‡ Since writing this note I have learned that a similar illusion is described in Le Conte's 'Sight.' It may however be new to some.

THE BOTANIST'S JOURNEY TO THE DENVER MEETING OF THE A. A. A. S.

FOR the observing botanist (and what kind of a botanist is he who is not observing?) the journey to the Denver meeting of the American Association for the Advancement of Science will be of the greatest interest. Leaving the originally wooded country some distance east

of Chicago, he enters the level prairies of Illinois, originally treeless except along the watercourses, and passes from these to the rolling prairies of Iowa, whose undulating surface was wanting in woody vegetation except in the broad valleys which border the streams. Now, as in Illinois, all over the landscape are lines and clumps of vigorous trees, all the result of man's work. What was once a treeless view is now as freely dotted over with trees as in the case of many a landscape in the originally wooded portions of the eastern United States. Crossing the Missouri River he soon enters the region of the Great Plains, with an elevation of 1,200 feet above the sea at the eastern border, rising rapidly across Nebraska to 2,000, 3,000 and 4,000 feet above the sea. If he follows the broad valley of the Platte River from Omaha to Denver, he will receive the impression that the Plains are 'as level as a house floor,' since he sees only the flat alluvial plain worn by the great river, and is ignorant of the fact that on each side are hills and valleys stretching away for hundreds of miles, the hills treeless as in the prairies, and the valleys with groves of trees along the margins of the streams. If he is fortunate enough to choose a route which crosses the hills and valleys of the Plains instead of following a single valley, he will see for himself this relation of the trees to the general surface of the country, and he may even see evidence of the westward march of the trees, where the fires no longer check their growth. With the increase in elevation the fringes of trees along the streams grow narrower and narrower, until at last they disappear altogether on the high plains at the foot of the mountains, 4,500 feet or more above the sea. This is the land of the 'sage brush,' 'dagger weed,' 'buffalo grass,' 'bunch grass' and 'cactus.' It is not a desert, and yet is as uninviting as one—until man runs little streams of water over it, when as if by magic it is transformed into a garden of flowers and fruits, or a farm of golden wheat and purple alfalfa. What water is to the plant is nowhere better shown than on these high Colorado plains, a mile above the sea. Then, still beyond, are the mountains, with a vegetation entirely unlike that of the plains at their base. Pines, spruces, firs, cedars are all of different species from those of the east, and not many of the deciduous trees are of species which are common along our Atlantic border. For the botanist who sees this flora for the first time it will be a novel experience to find that he can name scarcely a plant that he sees, whether herb, shrub or tree. He will need his collecting case and plant press, as it will be impossible for him to resist the desire to make specimens of the many interesting plants he finds at every turn.

THE SAND HILLS OF NEBRASKA.

The interesting region known as the Sand Hills of Nebraska may be visited by the botanists who attend the Denver meeting in August. They occupy an area of from 15,000 to 20,000 square miles in central and northern Nebraska, having a width of from 100 to 200 miles. The prevailing contour of the surface is irregular, consisting of rounded, swelling hills with gentle depressions between them, or elongated ridges with steep sides, enclosing deep valleys. These hills consist of sand or gravel, and when the surface vegetation is removed the sand is driven by the winds, and forms moving dunes. To a very large extent the surface configuration is such that the water which falls in the rains is not drained off in streams, but disappears in the porous soil or evaporates from the surface. Here and there are streams which find their way through the valleys and hills, and where these streams are of considerable size they have worn deep canyons. Such streams are always fed by many springs which burst out from the sides of the canyons, and doubtless in this way the water which falls upon the areas which have no surface drainage finds its exit.

The vegetation in the Sand Hills consists almost entirely of grasses and sedges intermingled with deep-rooted perennial herbaceous or woody plants. The perennial herbaceous plants are coarse, strong-growing species, and the woody plants are to a very large extent of low stature and with large, widely-spreading roots. Among these shrubs are the sand cherry (*Prunus besseyi*), shoe string (*Amorpha canescens*), one or more species of prairie clover (*Kuhnistera*), one or two species of wild roses (*Rosa arkansana* and *Rosa woodsii*), New Jersey tea (*Ceanothus ovatus*),

etc. In the wet valleys occur wild plums (*Prunus americana*), and the dwarf wild cherry (*Prunus demissa*), the former a shrub or small tree, and the latter an upright little-branched shrub, both usually forming close thickets.

The trees are almost entirely confined to the narrow belts which border the streams in the canyons. Where the canyons are deep these forest belts are entirely hidden as one glances over the undulating surface of the plain. In the eastern part of the Sand Hill region the forest belts are wider, but in passing westward they are narrower, the trees are lower, and eventually they are mere straggling shrubs, finally disappearing altogether. The species are to a large extent those found in the eastern portion of the State, there being but few cases in which the Rocky Mountain trees have taken possession of such protected areas. They are the white elm, occasionally the red elm, the box elder, red ash in small numbers, green ash in larger numbers, sometimes the hackberry, with the common cottonwood and several species of willows, and occasional hawthorns, with here and there the remnants of groves of bull pine (*Pinus scopulorum*).

THE GRASSY COVERING OF THE GREAT PLAINS.

THOSE who visit the Great Plains for the first time are usually interested in the grassy covering, which is the most marked feature of the vegetation of the region. This covering is mostly composed of a mixture of several species, there being few places where a single species occupies the ground to the complete exclusion of all others. In the eastern portion of the region the grassy plants (including sedges) number about 130 species, in the central portion (the Sand Hills) there are 170 species, while in the western portion (the Foot Hills) there are about 110 species. The eastern visitor will notice with interest the 'buffalo grass' (*Bulbilis dactyloides*) in well-marked patches, the different species of 'grama' (*Bouteloua oligostachya*, *B. hirsuta*, and *B. curtipendula*) scattered over the surface, the 'wheat grasses' (*Agropyron pseudorepens* and other species) usually mingled with species of *Bouteloua*, the 'bunch grasses' (*Andropogon scoparius*, *A. furcatus* and *A. hallii*) scattered in bunches over the surface, the 'needle grasses' (*Stipa spartea*, *S. comata* and *S. viridula*) scattered in bunches over the surface, with other species known in general as 'prairie grasses' (species of *Kœleria*, *Eatonia*, *Sporobolus*, etc.). Should he go into the Sand Hills he would find the 'blowout grasses' (*Muhlenbergia pungens*, *Eragrostis trichodes*, *Oryzopsis cuspidata* and *Redfieldia flexuosa*) in or on the margins of the naked sand pits blown out of the hillsides. In the Foot Hills he would find great areas covered almost exclusively with the yellowish-brown foliage of the little sedge (*Carex filifolia*) known throughout the region under the names 'nigger wool,' 'nigger root,' or 'black root,' highly esteemed by the stockmen for its nutritious qualities, and whose tough and durable black roots form a persistent sod much used by the settlers in the construction of their 'sod houses.'

TREES OF THE RYDBERG COTTONWOOD.

IT may be of interest to some of the botanists who will visit the Rocky Mountains this summer to know that they can see many fine specimens of the 'Rydberg cottonwood' (*Populus acuminata*) in the town of Colorado Springs. They have been planted along the streets and avenues mingled with trees of the common cottonwood (*Populus deltoidea*). Especially fine trees may be seen along the east side of Cascade avenue. Botanists will remember that in 1893 this tree was first described by Dr. Rydberg in the *Bulletin of the Torrey Botanical Club* (February, 1893) from material collected in the canyons of the Wildcat Mountains of Western Nebraska. Since the publication of the species it has been found to extend from the Black Hills southward to Southern Colorado, New Mexico and Arizona. In the plantings along the streets of Colorado Springs this species was not distinguished from the common cottonwood. The two trees may, however, be very easily distinguished by the shape and particular contour of the leaves, which are rhomboid-lanceolate with serrulate margins in the new species, in contrast to the broadly deltoid-ovate leaves of the common species with their incurved-dentate margins.

CHARLES E. BESSEY.
THE UNIVERSITY OF NEBRASKA.